

A high-speed photograph of a large splash of water, creating a complex, textured pattern of droplets and bubbles. The water is white and frothy, set against a solid light blue background. The splash is centered and fills most of the frame.

Volume 2

Chapter 15 Recharge Areas Protection



Natural and constructed recharge areas must be protected to maintain groundwater quantity and quality. (DWR photo)

Chapter 15 *Recharge Areas Protection*

Recharge areas protection includes keeping groundwater recharge areas from being paved over or otherwise developed and guarding the recharge areas so they do not become contaminated. Protection of recharge areas, whether natural or man-made, is necessary if the quantity and quality of groundwater in the aquifer are to be maintained. Existing and potential recharge areas must be protected so that they remain functional and they are not contaminated with chemical or microbial constituents. Zoning can play a major role in recharge areas protection by amending land-use practices so that existing recharge sites are retained as recharge areas. See Box 15-1 for more discussion on recharge areas.

Protection of recharge areas is important, but protecting recharge areas by itself does not provide a supply of water. Recharge areas only function when aquifer storage capacity is available, and when regional and local governments and agencies work together to secure an adequate supply of good quality water to recharge the aquifer. Protecting existing and potential recharge areas allows them to serve as valuable components of a conjunctive management and groundwater storage strategy.

Other Volume 2 strategies related to Recharge Areas Protection are Urban Runoff Management (Chapter 21), Groundwater Remediation/ Aquifer Remediation (Chapter 11), and Conjunctive Management and Groundwater Storage (Chapter 4).

Recharge Areas in California

The first documented managed recharge program in California began in Los Angeles basin in 1889. Beginning in the early 1900s, water agencies operated recharge areas in the San Joaquin Valley. Additional recharge areas were established later in Southern California and San Francisco Bay Area. While a certain amount of recharge takes place in many areas, the areas that were chosen by water management agencies were those areas that met three conditions. First, the sediment is coarse enough to allow surface water to infiltrate at a higher rate than through finer sediments. Second, there is hydraulic continuity between the recharge area, the aquifer in which the groundwater is stored and transported, and the discharge area where wells are built to extract the ground-

water. Third, a local agency had access to the land on which these first two conditions existed. Table 15-1 shows current recharge sites in California.

The size of existing recharge areas and the amount of groundwater that is recharged annually is substantial. The total amount of land devoted to spreading basins and off-stream and in-stream recharge probably exceeds 50 square miles. The actual area is difficult to determine, partially because many diversion ditches and creeks are active recharge sites during periods of the year. These active recharge areas and other areas should be protected for recharge purposes.

The Drinking Water Source Assessment Program (DWSAP) defines areas of protection for individual wells. The program can easily be expanded to include larger areas within the watershed. While the DWSAP requires assessment of these issues, the amendments to the Clean Water Act that require the assessment do not require implementation.

TreePeople, a citizens' organization, has been working with local government to retrofit playgrounds, school grounds, parking lots, and other parcels of land, to collect, treat, and funnel storm water to "dry" wells or other small scale infiltration facilities. Such wells are called Class V injection wells. While the goal of TreePeople is to reduce hardscapes and reduce runoff, the use of dry wells for disposal of the urban runoff can affect groundwater quality. To avoid contamination of the aquifer, certain best management practices are recommended. Those best management practices include low-flow basins for runoff from industrial areas and other areas that could

Table 15-1 Recharge sites in California

| Agency | Type of Recharge Site |
|------------------------------------|--|
| Arvin-Edison WSD | Off-stream |
| Berrenda Mesa WD | Off-stream |
| Calleguas MWD | Injection wells |
| City of Bakersfield | In-stream, off-stream |
| Coachella Valley WD | In-stream, off-stream |
| Flintridge-Cañada WD | Injection well |
| Fresno County FC&WCD | Off-stream, injection wells |
| Friant-Kern Water Users Authority | In-stream |
| Kern Water Bank | Off-stream |
| Los Angeles County DPW | In-stream, off-stream, injection wells |
| North Kern WSD | Off-stream |
| Orange County WD | In-stream, off-stream, injection wells |
| Pioneer (KCWA) | In-stream, off-stream |
| San Bernardino County WC&FCD | Off-stream |
| Santa Ana Watershed Project Auth. | Off-stream, injection wells |
| Santa Clara Valley WD | In-stream, off-stream |
| Semitropic WSD | Off-stream |
| United Water Conservation District | In-stream, off-stream |

provide a high level of chemical contamination, pre-treatment for runoff, monitoring of water quality, evaluation of the data, and corrective action as necessary. All counties are required to regulate any type of water-related well, including injection wells, but the effectiveness of that program are uncertain at best. Class V injection wells are further regulated for groundwater quality purposes by the U.S. Environmental Protection Agency in accordance with the Underground Injection Control program authorized by the Safe Drinking Water Act.

Benefits from Protection of Recharge Areas

The primary benefit of protecting recharge areas is to make storage available as part of a sustainable and reliable water supply of good quality. The availability of a sustainable and reliable water supply may lessen the need to purchase alternative water supplies at greater expense. Protection of recharge areas does not make a water supply available; a supply of water to recharge the aquifer depends on coordination of regional and local governments and agencies.

Additional benefits of recharging groundwater include some removal of microbes and chemicals while the water moves through the unsaturated zone to the saturated zone, an

increase in the amount of groundwater in storage that can later be extracted for local use or for export, and in some cases, use of the aquifer itself as the conveyance system from the recharge area to the point of extraction and use. In some cities, recharge basins are combined with flood control basins to reduce the amount of urban runoff.

Potential Costs

Some of the costs that may be associated with protecting recharge areas are:

- Purchase or lease price of the land that is to be used for a recharge area.
- Design and construction of facilities
- Land that is reserved for recharge areas cannot be used for other purposes that might provide a significant income for the landowner and tax revenues for the government
- If a local government agency owns the land, there is no tax income for the county

By not protecting recharge areas, water supply can be lost. The growth of urban areas, with roads, freeways, parking lots, and large warehouse type buildings, means that many areas

no longer allow runoff to infiltrate into the ground. Instead, the runoff flows rapidly into streams which peak more quickly and at higher flow rates than before the urban facilities were built. This runoff is lost to groundwater recharge and may require the expense of other facilities to provide a substitute for that lost recharge. In some urban areas, injection wells have been built to take the place of recharge that was lost to urban development. Injection wells are expensive and are not always successful, but they may be cost effective in the face of the high cost of urban land in many cities.

Many potentially contaminating activities have routinely been allowed in recharge areas and contaminants have been carried into the aquifers. Remediation of these areas can

take decades, costs millions or billions of dollars, and will never remove the contaminant completely from the aquifer. In such cases, the extracted groundwater must be treated at the wellhead at significant expense before it is suitable for potable and other uses.

A lack of protection of recharge areas could decrease the availability of usable groundwater. Recent studies by the U.S. Geological Survey show contaminants present in recharge areas for aquifers in the Los Angeles area. In 10, 20, or 40 years, those contaminants will have been transported into the aquifer and the groundwater may require treatment before it can be used, thereby increasing the cost of water to the users. Protection of recharge areas now will help to prevent costs

Box 15-1 Recharge Areas

Recharge areas are those areas that provide the primary means of replenishing the groundwater that is stored in an aquifer. In simple terms, a groundwater system consists of three component parts—recharge areas, storage capacity called an aquifer, and discharge areas or points. If recharge areas cease functioning properly, there is no water to store in, or remove from, the aquifer. Under natural conditions sandy areas that lie over alluvial aquifers provide good recharge areas for that aquifer.

Natural recharge takes place without interference or assistance from people. Artificial, intentional, or managed recharge is additional recharge that takes place with the assistance of people. Artificial, intentional, or managed recharge can take place in areas where natural recharge occurs (stream channels or alluvial fans) by increasing flow volume and decreasing flow velocity. In addition, this recharge can take place in structures built specifically for increasing recharge. These structures are called recharge basins, spreading basins or replenishment basins or areas. The goal of all managed recharge is to increase the rate of infiltration or percolation of surface water into the subsurface, and ultimately, into the saturated zone in the aquifer. Some areas that would provide good rates of recharge have been paved over or built upon and are no longer available to recharge the aquifer.

The three types of recharge that are possible are in-stream, off-stream, and injection wells. In-stream recharge allows water to percolate through the stream bed itself. Off-stream recharge uses suitable sites outside the streambed. In some operations, the water must be pumped some distance from its source to the off-stream recharge area. Injection wells are used at locations where the cost of large tracts of land would be prohibitive.

Each method has pros and cons. In-stream and off-stream spreading basins are eventually clogged with the suspended material carried in the surface water to the point that the rate of recharge declines considerably, making the basin much less effective. Those fines must somehow be removed. In urban areas the cost of land necessary for spreading basins may be prohibitive. Injection wells are expensive to build and are also subject to clogging unless the water is treated and turbidity is nil.

Protection of recharge areas consists of two components: (1) preventing the areas from being covered by urban infrastructure, which renders the land unusable for recharge; and, (2) preventing chemical or microbial contamination that would require expensive treatment before the water could be used for potable, agricultural, or industrial purposes

from escalating astronomically in the future. Because of the low velocity of groundwater movement through the aquifer, contamination that occurs today may not arrive at down-gradient wells for 10 years or longer. If we protect recharge areas by retaining those areas for recharge and by preventing contamination today, we are reducing future costs.

Major Issues Relating to Protection of Recharge Areas

Data and Standards

There is a lack of standardized guidelines for pre-treatment of the recharge water, including recycled water. There is also a lack of monitoring wells to provide data on changes in groundwater quality that may be caused by recharge. Inspection programs are generally not adequately funded and staffed to locate, inspect, design protection measures, and destroy abandoned wells that provide vertical conduits for contamination of aquifers.

Zoning

Local governments often lack a clear understanding of recharge areas and how to protect those areas from development or contamination. Land use zoning does not always recognize the need for recharge area protection for water quantity and water quality.

Vector and Odor Issues

Standing water in recharge ponds or spreading basins is an attraction for mosquitoes, dragonflies, and other insects whose egg, larval, and pupal stages mature underwater. Dragonflies eat insects they catch on the fly, but mosquitoes can be vectors for a number of serious or deadly diseases. Existing recharge programs use large numbers of “mosquito” fish which feed on the mosquito larvae in the water. Odors can be generated by growth and decay of algae and other water-borne vegetation. Both vectors and odors must be addressed in any recharge program that involves standing water.

Potential Impacts

Protection of recharge areas can remove land from availability for other uses.

Recommendations to Help Promote Protection of Recharge Areas

The State can help promote additional protection of recharge areas by acting on the following recommendations:

1. Increase State funding for proposals to identify and protect recharge areas including incentives for the location and proper destruction of abandoned water wells, monitoring wells, cathodic protection wells and other wells that could become vertical conduits for contamination of the aquifer. Provide funding and staff for Department of Health Services to initiate a program that would provide guidance and funding for local governments and agencies to implement source water protection measures that are logical outgrowths of the Drinking Water Source Assessment Program.
2. Expand research into surface spreading as a means of groundwater recharge and the fate of chemicals and microbes contained in the recharge water.
3. Develop a statewide program to identify potential recharge areas throughout the state and provide that information to city and county governments.
4. Amend State law to prohibit local decision-makers from developing land for other purposes until it is known if that land is needed for recharge as a part of the local agency's groundwater management program.
5. Engage the public in an active dialogue using a value-based decision-making model in planning land use decisions that involve recharge areas. Adopt a State-sponsored media campaign to increase public awareness and knowledge of groundwater and the importance of recharge areas.
6. Establish a “Water” element in the General Plan process that specifically requires a discussion by local government of the cost and values of protecting recharge areas versus the cost of non-protection. Eminent domain should not be allowed to convert potential recharge areas to other uses.¹
7. Ensure that federal and State programs regulating subsurface disposal in accordance with the Safe Drinking Water Act's Underground Injection Control program and the California Clean Water Act's waste discharge requirements are fully funded and staffed.

¹ For a fuller discussion of the proposed water element in a General Plan, please refer to “Planning for a Demanding Water Future: The Legal Requirements for Long-Term Land Use and Water Planning in California, and an Analysis of a Water Element in the General Plan as a Means to Improve the Connection,” found in Volume 4.

8. Require local governments to provide protection of recharge areas for aquifers that have been identified as “sole source aquifers” pursuant to the Safe Drinking Water Act of 1974 (P.L. 93-523) and Amendments.
 9. Develop educational programs for public works officials and other officials of local agencies and governments that will allow them to develop programs that realistically deal with the interaction of groundwater, surface water, storm water, other surface flows, and the affect of contaminants in surface flows on contaminant levels in the aquifers.
 10. Require that source water protection plans include an element that addresses recharge areas if groundwater is a part of the supply.
 11. Convene a statewide panel to recommend changes to public schools and higher education curricula relating to groundwater. Encourage an integrated academic program on one or more campuses for protection of groundwater quantity and quality and why recharge areas are critical components.
 12. Develop a uniform method for analyzing the economic benefits and cost of recharge areas and provide guidance and assistance for economic feasibility analyses that could be used by project planners and funding agencies to assess recharge areas as compared with long-term reduction of water supplies, wellhead treatment, or injection wells.
 13. Develop a signage program, modeled on such programs in other states, to notify people that they are entering an area of critical recharge for the groundwater they use daily, and that improper disposal of wastes can contaminate their drinking water.
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